Photomemristor sensor based on two-dimensional crystals for artificial vision

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Abstract:

Processing of visual information in a photomemristor based on low-dimensional materials[1-6] allows creating a compact and energy-efficient autonomous sensor of vision and recognition of visual information for use in personal medicine and other applications[2,4]. The emergence of graphene family crystals opens up unique opportunities for processing electrical[7,8] and optical[3-6] signals in real time in a wide spectral range from ultraviolet to infrared radiation. Energy-independent resistive states in photomemristor nanostructures fabricated on the basis of two-dimensional crystals and quantum dots[9,10] can be controlled by photoelectric polarization[1], ferroelectric and ferromagnetic states[11,12], photoinduced structural transitions[3], as well as the rearrangement of carbon atoms in sp^2-sp^3 hybridization in an electric field[7,8,13]. Such devices have high photosensitivity[14] and demonstrate dynamic behavior[5] required for neuromorphic computing directly in the sensor, which allows to reduce energy and time costs during visual information processing associated with the transfer of data between the detector, memory and processor in the classical von Neumann architecture. This opens up the possibility of rapid classification and recognition of objects in an intelligent sensor with an embedded neural network, similar to the processing of visual information in the retina[6].

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Biography of Presenter:

Gennady N. Panin graduated from the Moscow Institute of Electronic Technology with a degree in Applied Physics and Electronics and defended his PhD thesis in the field of solid-state electronics. He worked as a Research Fellow at the Institute of Microelectronics Technology RAS (IMT RAS), a Visiting Scientist at the Institute of Solid-State Physics, Halle, a Postdoc at the Complutense University of Madrid, Research Professor at the Quantum Functional Semiconductor Research Center (QSRC), Dongguk University, Seoul, Professor at the Academy of Nano-Information Technologies (NITA) and QSRC (2008-2020); Deputy Director of QSRC and NITA (2012-2020). Currently, he is a Leading Researcher at IMT RAS, an expert in the field of neuromorphic technologies, the author of more than 200 articles, 50 invited talks and 35 patents.

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